

**SECTION I**  
**AMENDMENTS**

**IN THE CLAIMS:**

Please amend claims 1, 7, 15, 22 and 30 as set forth below.

**Complete Listing of the Claims**

Upon entry of the present amendment, the claims will stand as follows. The following listing of the claims will replace all prior versions and listings of the claims in the present application:

1. (Withdrawn – Currently amended) A method for producing a high density CNT film or pattern consisting essentially of laminated CNT layers having carboxyl groups exposed on its surface, which comprises the steps of:
  - (a) reacting a substrate having amine groups exposed on the surface or a substrate having amine groups exposed in a pattern with CNT having exposed carboxyl groups to form a CNT single layer or single layer pattern on the surface of the substrate by amidation reaction between the amine groups and the carboxyl groups;
  - (b) reacting the CNT single layer or single layer pattern with an organic diamine to modify the CNT single layer with organic amine groups and reacting the organic amine groups with the CNT having exposed carboxyl groups to laminate a CNT layer thereon, wherein the CNT layer is laminated directly on the CNT single layer or single layer pattern without use of a chemical anchor; and
  - (c) repeating the step (b) to form laminated CNT layers, thereby forming a high density CNT film or pattern having exposed carboxyl groups.
2. (Withdrawn) The method according to claim 1, wherein the substrate is selected from the group consisting of silicon, glass, melted silica, plastics and PDMS.
3. (Withdrawn) The method according to claim 1, wherein the substrate having amine groups exposed on its surface is prepared by treating the substrate with aminoalkyloxysilane.

4. (Withdrawn) The method according to claim 1, wherein the substrate having the amine groups exposed in a pattern is prepared by forming a photoresist or organic supra-molecule pattern on the substrate having the exposed amine groups.
5. (Withdrawn) The method according to claim 1, wherein the substrate having the amine groups exposed in a pattern is prepared by forming a photoresist or organic supra-molecule pattern on a substrate, followed by treatment with aminoalkyloxysilane.
6. (Cancelled)
7. (Currently amended) A high density carbon nanotube (CNT) film or pattern consisting essentially of laminated CNT layers which is prepared by a method comprising the steps of:
  - (a) reacting a substrate having amine groups exposed on the surface or a substrate having amine groups exposed in a pattern with CNT having exposed carboxyl groups to form a CNT single layer or single layer pattern on the surface of the substrate by amidation reaction between the amine groups and the carboxyl groups;
  - (b) reacting the CNT single layer or single layer pattern with an organic diamine to modify the CNT single layer with organic amine groups and reacting the organic amine groups with the CNT having exposed carboxyl groups to laminate a CNT layer thereon, wherein the CNT layer is laminated directly on the CNT single layer or single layer pattern without use of a chemical anchor; and
  - (c) repeating step (b) to form laminated CNT layers, thereby forming a high density CNT film or pattern having exposed carboxyl groups.
8. (Previously presented) A method for fabricating a CNT-biochip comprising bio-receptors fixed to carboxyl groups exposed on the CNT film or pattern according to claim 7 by chemical or physicochemical bond, in which each bio-receptor has a functional group capable of binding to a carboxyl group.
9. (Previously presented) The method according to claim 8, wherein the chemical functional group capable of binding to a carboxyl group is an amine group or a hydroxyl group.
10. (Previously presented) A CNT-biochip which is prepared by the method according to claim 8, and comprising bio-receptors fixed to carboxyl groups exposed on the CNT film or

pattern by chemical or physicochemical bond, in which each bio-receptor has a functional group capable of binding to a carboxyl group.

11. (Original) The CNT-biochip according to claim 10, wherein the bio-receptor is selected from the group consisting of a enzyme substrate, a ligand, an amino acid, a peptide, protein, DNA, RNA, PNA, lipid, a cofactor and a carbohydrate.

12. (Withdrawn) The CNT-biochip according to claim 11, wherein the bio-receptor is DNA.

13. (Original) A method for detecting a target biomaterial capable of binding to or interacting with a bio-receptor, wherein the method is characterized by using the CNT-biochip according to claim 10.

14. (Withdrawn) A method for detecting DNA hybridization, wherein the method is characterized by using the CNT-DNA chip according to claim 12.

15. (Withdrawn – Currently amended) A method for producing a high density CNT film or pattern consisting essentially of laminated CNT layers having exposed chemical functional groups selected from the group consisting of amine groups, aldehyde groups, hydroxyl groups, thiol groups and halogens, on its surface, which comprises the steps of:

- (a) reacting a substrate having amine groups exposed on the surface or a substrate having amine groups exposed in a pattern with CNT having exposed carboxyl groups to form a CNT single layer or single layer pattern on the surface of the substrate by amidation reaction between the amine groups and the carboxyl groups;
- (b) reacting the CNT single layer or single layer pattern with an organic diamine to form an organic amine layer on the CNT single layer and reacting the organic amine groups with the CNT having exposed carboxyl groups to laminate a CNT layer thereon, wherein the CNT layer is laminated directly on the CNT single layer or single layer pattern without use of a chemical anchor;
- (c) repeating the step (b) to form laminated CNT layers, thereby forming a high density CNT film or pattern having exposed carboxyl groups; and
- (d) modifying the high density CNT film or pattern having exposed carboxyl groups with a chemical compound having both a functional group capable of binding to

a carboxyl group and a chemical functional group selected from the group consisting of amine group, aldehyde group, hydroxyl group, thiol group and halogen.

16. (Withdrawn) The method according to claim 15, wherein the substrate is selected from the group consisting of silicon, glass, melted silica, plastics and PDMS.

17. (Withdrawn) The method according to claim 15, wherein the substrate having amine groups exposed on its surface is prepared by treating the substrate with aminoalkyloxysilane.

18. (Withdrawn) The method according to claim 15, wherein the substrate having the amine groups exposed in a pattern is prepared by forming a photoresist or organic supra-molecule pattern on the substrate having the exposed amine groups.

19. (Withdrawn) The method according to claim 15, wherein the substrate having the amine groups exposed in a pattern is prepared by forming a photoresist or organic supra-molecule pattern on a substrate, followed by treatment with aminoalkyloxysilane.

20. (Withdrawn) The method according to claim 15, wherein the chemical functional group capable of binding to a carboxyl group is an amine group or a hydroxyl group.

21. (Withdrawn) The method according to claim 15, wherein the chemical compound having both a functional group capable of binding to a carboxyl group and a chemical functional group selected from the group consisting of amine group, aldehyde group, hydroxyl group, thiol group and halogen include  $\text{H}_2\text{N-R}_1\text{-NH}_2$ ,  $\text{H}_2\text{N-R}_2\text{-CHO}$ ,  $\text{H}_2\text{N-R}_3\text{-OH}$ ,  $\text{H}_2\text{N-R}_4\text{-SH}$ , or  $\text{H}_2\text{N-R}_5\text{-X}$  in which  $\text{R}_1$ ,  $\text{R}_2$ ,  $\text{R}_3$ ,  $\text{R}_4$  and  $\text{R}_5$  are independently a  $\text{C}_{1-20}$  saturated hydrocarbon, un-saturated hydrocarbon or aromatic organic group and X is halogen element.

22. (Currently amended) A high density CNT film or pattern consisting essentially of laminated CNT layers which is prepared by a method comprising the steps of:

- (a) reacting a substrate having amine groups exposed on the surface or a substrate having amine groups exposed in a pattern with CNT having exposed carboxyl groups to form a CNT single layer or single layer pattern on the surface of the substrate by amidation reaction between the amine groups and the carboxyl groups;

- (b) reacting the CNT single layer or single layer pattern with an organic diamine to form an organic amine layer on the CNT single layer and reacting the organic amine groups with the CNT having exposed carboxyl groups to laminate a CNT layer thereon, wherein the CNT layer is laminated directly on the CNT single layer or single layer pattern without use of a chemical anchor;
- (c) repeating step (b) to form laminated CNT layers, thereby forming a high density CNT film or pattern having exposed carboxyl groups; and
- (d) modifying the high density CNT film or pattern having exposed carboxyl groups with a chemical compound having both a functional group capable of binding to a carboxyl group and a chemical functional group selected from the group consisting of amine group, aldehyde group, hydroxyl group, thiol group and halogen;

wherein the high density CNT film or pattern has exposed chemical functional groups on its surface, in which the chemical functional groups are any one selected from the group consisting of amine groups, aldehyde groups, hydroxyl groups, thiol groups and halogens.

23. (Previously presented) A method for fabricating a CNT-biochip comprising bio-receptors fixed to the chemical functional groups according to claim 22 by chemical or physicochemical bond, in which the bio-receptors each have a functional group capable of binding to a chemical functional group.

24. (Previously presented) A method according to claim 23, wherein the chemical compound having both a functional group capable of binding to a carboxyl group and a chemical functional group selected from the group consisting of amine group, aldehyde group, hydroxyl group, thiol group and halogen include  $H_2N-R_1-NH_2$ ,  $H_2N-R_2-CHO$ ,  $H_2N-R_3-OH$ ,  $H_2N-R_4-SH$ , or  $H_2N-R_5-X$  in which  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$  and  $R_5$  are independently a  $C_{1-20}$  saturated hydrocarbon, unsaturated hydrocarbon or aromatic organic group and X is halogen element.

25. (Previously presented) A CNT-biochip which is prepared by the method according to claim 23.

26. (Original) The CNT-biochip according to claim 25, wherein the bio-receptor is selected from the group consisting of a enzyme substrate, a ligand, an amino acid, a peptide, protein, DNA, RNA, PNA, lipid, a cofactor and a carbohydrate.

27. (Withdrawn) The CNT-biochip according to claim 26, wherein the bio-receptor is DNA.
28. (Original) A method for detecting a target biomaterial capable of binding to or interacting with a bio-receptor, wherein the method is characterized by using the CNT-biochip according to claim 25.
29. (Withdrawn) A method for detecting DNA hybridization, wherein the method is characterized by using the CNT-DNA chip according to claim 27.
30. (Currently amended) A multilayer CNT structure, ~~comprising~~ consisting essentially of a substrate and multiple CNT layers on the substrate, wherein said multiple CNT layers include (i) CNTs bonded to the substrate via peptide linkages (-NHC(O)-), (ii) CNTs bonded to other CNTs via linkers including CNT-connecting peptide linkages (-NHC(O)-) and (iii) CNTs having pendant carboxyl functionality and wherein the multiple CNT layers are bonded to other CNTs without use of a chemical anchor.
31. (Original) A multilayer CNT structure according to claim 30, further including a bio-receptor coupled thereto.

**THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK**